Chapter 6: Cash flows for investment analysis

Net present value depends on future cash flows. Cash flow is the simplest possible concept; it is just the difference between dollars received and dollars paid out that have to do with the project. To calculate cash flows we can rely on the income statement of the project. However, there are differences between cash flow for capital budgeting and accounting income.
Generally accepted accounting principles require the recognition of revenues when the service for which the firm is getting paid has been performed in full or substantially, and the firm has received in return either cash or a receivable that is both observable and measurable. For expenses that are linked to the production of revenues (like labour and materials), expenses are recognized in the same period in which revenues are recognized. Any expenses that are not directly linked to the production of revenues are recognized in the period in which the firm consumes the services.
Although the objective of distributing revenues and expenses fairly across time is to normalize earnings over time, the process of accrual accounting does create an accounting earnings number that can be different from the cash flow generated by the project. The difference arises mainly for three reasons. These come from the fact that accounting distinct:

1. Operating expenses from capital expenses
2. Cash from noncash expenses
3. Accrual from cash revenues and expenses

6.1. Accounting earnings vs cash flows

6.1.1. Operating expenses and capital expenses

Accountants distinguish between expenditures that yield benefit only in the intermediate period or periods (such as labour or raw materials) and those that yield benefit on a multiple periods (such as land, building and long-lived assets). The former are called *operating expenses* and are subtracted from revenues in computing the accounting income, while the later are *capital expenditures* and are not subtracted from revenues in the period that they are made. Instead, the capital expenditure is spread over multiple periods and deducted as an expense in each period. These expenses are called **depreciation** (if the asset is a tangible asset like building) or **amortization** (if the asset is intangible asset like a patent or a trademark).
Although the capital expenditures made in the beginning of a project are often the largest and most prominent, many projects require additional capital expenditures during their lifetime, thus reducing the availability of cash during these periods. Therefore, when calculating cash flows we need to take into account both the initial capital expenditures and any subsequent capital expenditures, required to maintain the asset base of the project.

6.1.2. Noncash expenses

The previous distinction between operating and capital expenditures leads to a number of accounting expenses, such as depreciation and amortization, which are not cash expenses. These noncash expenses, though reducing accounting income, do not reduce cash flows. In fact, they can have a significant positive impact on cash flows, if they reduce the tax liability of the firm. For instance, depreciation reduces taxable and net income, but it does not cause cash outflow. Consequently, depreciation is added back to income to arrive at the cash flows on a project. The tax benefit of depreciation on cash flows can be written as:

$$\text{Tax benefit of depreciation} = \tau_c \times \text{Depreciation}$$

where τ_c is the corporate tax rate.

6.1.3. Accrual vs cash revenues and expenses

Accountants recognize revenues when the sale is made rather than when the customer pays. Consequently, accrual revenues may differ from cash revenues. This difference may arise when customers who bought goods and services in prior periods may pay in this period, or others that buy goods and services today may defer their payments until future periods.

A similar problem may arise on the expense side. Firm have to report expenses as they use material and services provided by third parties, but they might not pay for them until subsequent years. In addition, payments might be made for materials are services acquired in prior periods.

When material is used to produce a product or deliver a service you need to consider that this material may have been acquired in previous periods and was brought in as inventory into this period, and some of the material that is acquired in this period may be taken into the next period as inventory. The same holds for finished goods, which may be produced in previous periods and was brought in as inventory into this period.

Accountants define **net working capital** (or **working capital**) as the difference between current assets (such as inventory of materials and finished goods and account receivables) and current liabilities (such as accounts payable and taxes that have been incurred but not yet paid).

Most projects entail an investment in working capital, which should be recognized in the cash flows calculations. When the project comes to an end, you can usually recover this investment as inventories are run down and any unpaid bills are paid off. This generates an end-of-period cash inflow.

However, we are not interested in the working capital itself but in the change in working capital for one period to the other. It is actually the change that measure any cash inflow or outflow associated with the project. For example, assume that at the end of year 2 the project's requirements for working capital are as follows:

$$1,289 = \underbrace{635}_{\text{inventory}} + \underbrace{1,030}_{\substack{\text{Accounts}\\ \text{receivable}}} - \underbrace{376}_{\substack{\text{Accounts}\\ \text{payable}}}$$

Now assume that at the end of year 3 the investment of working capital is as follows:

$$1,972 = \underbrace{972}_{\text{inventory}} + \underbrace{1,500}_{\substack{\text{Accounts}\\ \text{receivable}}} - \underbrace{500}_{\substack{\text{Accounts}\\ \text{payable}}}$$

We observe an increase in the working capital which means that an extra investment took place between year 2 and year 3. This extra investment equals 1,972 – 1,289 = 683, which is a cash outflow. Thus, in general, if we denote as WC_t the working capital at period t, then the change in working capital equals:

$$CWC_t = WC_t - WC_{t-1}$$

6.2. Further considerations for cash flows calculation

Incremental cash flows: When analysing a project, the objective is to answer the question: Will this project make the entire firm more valuable? Consequently, the cash flows we should look at in investment analysis are the cash flows the project creates in addition to the existing cash flows of the firm. We will call these cash flows **incremental cash flows**. The total and incremental cash flows of the project will generally be different for two reasons. The first is that some of the cash flows on an investment may have occurred already and therefore are unaffected by whether or not we take the investment. Such cash flows are known as **sunk costs** and should be removed from the analysis. Examples of sunk costs are expenses associated with a market test of a new product and those related to research and development. Both of these costs occur well before full-scale production and will not be recovered if the project is rejected. Thus, they are incremental and therefore they should not be considered as part of the investment analysis.
The second reason for which total and incremental cash flows are different is the existence of **allocated overhead costs**. An accounting practice ensures that every part of a business bear its fair share of costs, when these cannot be traced to specific revenues generated by individual products or divisions. These costs are allocated across these units, based on revenues, profits or assets. Not all of these costs are incremental. In fact, it is possible that none of these costs affect the incremental cash flows. For example, when a retail firm opens a new store, it should share the total advertising expenses of the firm as a whole. But these expenses would have been paid whether or not the new store is open. Thus, the advertising costs allocated to the new store cannot be considered as incremental, and thus, they should affect the investment analysis.

Include opportunity costs: The cost of a resource may be relevant to the investment decision even when no cash changes hand. For example, suppose a new manufacturing operation uses land that otherwise could have been sold for $100,000. This resource is not free: It has an opportunity cost, which is the cash it could generate for the company if the project were rejected and the resource were sold or put to some other productive use.

Include all incidental effects: It is important to consider a project's effects on the remainder of the firm's business. For example, the launch of a new product may negatively affect demand of existing products. This incidental effect should be accounted in the incremental cash flows. Also, if the new project generates negative pre-tax revenues, then this will have a positive effect on the total tax payments of the firm.

Salvage value: When the project comes to an end, you may be able to sell or redeploy the assets it. If these assets are sold, you must pay tax on the difference between the sale price and the book value of them. The salvage value (net of any taxes) represents a cash inflow to the firm.

6.3. Estimating cash flows to the firm and to equity investors

When doing investment analysis we can estimate the cash flows from the perspective of just the equity investors or estimate the returns to all claim holders of the firm, such as the debt holders. As we have already discussed accounting earnings can deviate from the cash flows. In fact, to get from after-tax operating earnings to cash flows to all investors in the firm we have to:

1. Add back all noncash expenses, such as depreciation and amortization
2. Subtract all cash outflows that represent capital expenditures
3. Measure the effect of the change in the working capital. As already noted, when working capital increases, this produces a cash outflow, whereas if it decreases, there would be a cash inflow.

In general we can write,

$$\text{CF to firm} = \text{EBIT}\left(1-\tau_c\right) + \text{Dep} - \text{CWC} - \text{CE}$$

where,
EBIT = earnings before interest and taxes
Dep = depreciation and amortization
CWC = change in working capital
CE = capital expenditure

The cash flow to firm is a pre-debt, after-tax cash flow that measures the cash flow generated by a project for all claim holders in the firm, after reinvestment needs have been met.
To get from net income, which measures the earnings of equity investors, to cash flows to equity investors requires the additional step of considering the net cash flow created by repaying the old debt and taking a new debt. The difference between new debt issues and debt repayments is called the net debt, and it has to be added back to arrive at cash flows to equity. In general we can write,

$$\text{CF to equity} = \text{NI} + \text{Dep} - \text{CWC} - \text{CE} + \left(\text{New debt} - \text{Debt repayments}\right)$$

where NI denotes the net income. The cash flows to equity measures the cash flows generated by a project for equity investors in the firm, after tax, debt repayments and reinvestment needs.

Example: Consider a retail firm that plans to open a new store. The following information relates to the proposed store:

1. It will require an initial investment of $20 million in land, building and fixtures.
2. The firm will borrow $5 million at an interest rate of 5.8% using a 10-year loan. The loan will be repaid off in equal annual increments.

3. The store will have a life of 10 years. During that period, the store investment will be depreciated using straight-line depreciation. At the end of the 10^{th} year, the investments are expected to have a salvage value of $7.5 million.
4. The store is expected to generate revenues of $40 million in year 1 and these revenues are expected to grow 5% a year for the remaining 9 years of the project.
5. The operating expenses are expected to be 10% lower than the revenues.
6. Investments in working capital are made at the beginning of each period. The initial investment in working capital at time 0 is $3.2 million and is the 8% of revenues in year 1. The changes in working capital for the years that follow are 8% of the changes in revenues in these years. At the end of year 10 the entire investment in working capital is recovered.
7. The tax rate is 35%.

In a first step we will estimate the net income. To do so, we first need to calculate the interest and principal payments on the debt used in financing the store as shown in Table 1.

Table 1: Interest and principal payments on debt

Year	Total payment	Interest	Principal repaid	Remaining principal
0				5,000,000
1	672,917	290,000	382,917	4,617,083
2	672,917	267,791	405,127	4,211,956
3	672,917	244,293	428,624	3,783,332
4	672,917	219,433	453,484	3,329,848
5	672,917	193,131	479,786	2,850,062
6	672,917	165,304	507,614	2,342,448
7	672,917	135,862	537,055	1,805,393
8	672,917	104,713	568,205	1,237,188
9	672,917	71,757	601,160	636,028
10	672,917	36,890	636,028	0

Then in Table 2 we calculate the net income. The depreciation is calculated as 20,000,000/10 = 2,000,000.
The EBIT (earnings before interest and taxes) is given as:

$$\text{EBIT} = \text{Revenues} - \text{Operating expenses} - \text{Dep}$$

Then we deduct the interest expenses to calculate the taxable income. Thus,

$$\text{Taxable income} = \text{EBIT} - \text{Interest}$$

Taxes paid are calculated as the 35% of the taxable income. Finally, the net income is calculated as:

$$\text{Net income} = \text{Taxable income} - \text{Taxes}$$

Table 2: Net income

Year	Revenues	Operating expenses	Depreciation	EBIT	Interest	Taxable income	Taxes	Net income
1	40,000,000	36,000,000	2,000,000	2,000,000	290,000	1,710,000	598,500	1,111,500
2	42,000,000	37,800,000	2,000,000	2,200,000	267,791	1,932,209	676,273	1,255,936
3	44,100,000	39,690,000	2,000,000	2,410,000	244,293	2,165,707	757,997	1,407,709

4	46,305,000	41,674,500	2,000,000	2,630,500	219,433	2,411,067	843,873	1,567,193
5	48,620,250	43,758,225	2,000,000	2,862,025	193,131	2,668,894	934,113	1,734,781
6	51,051,263	45,946,136	2,000,000	3,105,126	165,304	2,939,823	1,028,938	1,910,885
7	53,603,826	48,243,443	2,000,000	3,360,383	135,862	3,224,521	1,128,582	2,095,938
8	56,284,017	50,655,615	2,000,000	3,628,402	104,713	3,523,689	1,233,291	2,290,398
9	59,098,218	53,188,396	2,000,000	3,909,822	71,757	3,838,065	1,343,323	2,494,742
10	62,053,129	55,847,816	2,000,000	4,205,313	36,890	4,168,423	1,458,948	2,709,475

In Table 3 we calculate the cash flows to firm. As already shown we add to the operating earnings the depreciation and we subtract the change in working capital. At year 10 we also add the salvage value after taxes are being paid.

Table 3: Cash flows to firm

Year	Capital expenditure	EBIT	Operating earnings	Depreciation	Change in working capital	Salvage value (after-tax)	CF to firm
0	-20,000,000				-3,200,000		-23,200,000
1		2,000,000	1,300,000	2,000,000	-160,000		3,140,000
2		2,200,000	1,430,000	2,000,000	-168,000		3,262,000
3		2,410,000	1,566,500	2,000,000	-176,400		3,390,100
4		2,630,500	1,709,825	2,000,000	-185,220		3,524,605
5		2,862,025	1,860,316	2,000,000	-194,481		3,665,835
6		3,105,126	2,018,332	2,000,000	-204,205		3,814,127
7		3,360,383	2,184,249	2,000,000	-214,415		3,969,833
8		3,628,402	2,358,461	2,000,000	-225,136		4,133,325
9		3,909,822	2,541,384	2,000,000	-236,393		4,304,991
10		4,205,313	2,733,453	2,000,000	4,964,250	4,875,000	14,572,704

Finally, in Table 4 we calculate the cash flows to equity investors. As already shown we add to the net income the depreciation, we subtract the change in working capital and we add the net debt payment. In this example there is no new debt issued during the life of the project. Thus, the net debt payment only includes the principal payments that are made to debt holders. Note that interest payments are not included in the debt payment as we have already accounted them for in the net income. Again, the salvage value after-tax is also added to the calculation of cash flows to equity investors.

Table 4: Cash flows to equity investors

Year	Capital expenditure	Net income	Depreciation	Principal repaid	Change in working capital	Salvage value (after-tax)	CF to equity
0	-20,000,000			5,000,000	-3,200,000		-18,200,000
1		1,111,500	2,000,000	-382,917	-160,000		2,568,583
2		1,255,936	2,000,000	-405,127	-168,000		2,682,809
3		1,407,709	2,000,000	-428,624	-176,400		2,802,685
4		1,567,193	2,000,000	-453,484	-185,220		2,928,489
5		1,734,781	2,000,000	-479,786	-194,481		3,060,514
6		1,910,885	2,000,000	-507,614	-204,205		3,199,066

7	2,095,938	2,000,000	-537,055	-214,415		3,344,468
8	2,290,398	2,000,000	-568,205	-225,136		3,497,057
9	2,494,742	2,000,000	-601,160	-236,393		3,657,189
10	2,709,475	2,000,000	-636,028	4,964,250	4,875,000	13,912,698

6.4. Free cash flow to equity discount models

In Chapter 4 we have written the dividend discount model to determine the current value (or the expected return) of a common stock. However, two significant problems are associated with the use of dividends to value equity. The first is that it works only if cash flows to equity investors take the form of dividends. Thus, it will not work for valuing equity in private business, where the owners often withdraw cash from the business but may not call it dividends. It may not also work with publicly traded companies if they return cash to equity investors by buying back stocks. The second problem is that the use of dividends is based on the assumption that the firms pay out what they can afford in the form of dividends. When this is not true, and the firm pays more or less than it can afford as dividends, the dividend discount model will estimate the value of equity incorrectly.

To counter this problem, we consider a broader definition of cash flow that we call **free cash flow to equity**. This is defined as the cash left over after operating expenses, interest expenses, net debt payments, reinvestment and working capital needs. The definition is exactly the same to that given in the previous section for the project cash flow to equity. The only difference is that now, all the variables refer to the firm overall and not to a specific project.

Once the free cash flow to equity have been estimated, we discount them with an appropriate discount rate to calculate the value of equity, following the same process as with dividends. Then by dividing the value of equity capital by the number of outstanding shares we can calculate the current price per share. For example, following the assumptions of the Gordon growth model (i.e., the free cash flow to equity will grow infinitely with a constant growth rate g), we have that:

$$V_0 = \frac{FCFE_1}{r - g}$$

where $FCFE_1$ denotes the free cash flow to equity at year 1. Then, if N denotes the number of outstanding shares, $P_0 = V_0 / N$.

EXERCISES-6

1. The treasurer of United Southern Capital Co. has submitted a proposal to the board of directors to replace an old machine by a new one. The cost of the new machine is $900 and he argues that would save $290 in labour cost. The new equipment has a 5-year life. If the firm has a 50% tax rate, uses straight-line depreciation, and has a 10% OCC, should the project be accepted? Income statements before and after the project are given in the following tables.

Before	1	2	3	4	5
Revenue	1,000	1,000	1,000	1,000	1,000
Variable cost	500	500	500	500	500
Depreciation	300	300	300	300	300

After	1	2	3	4	5
Revenue	1,000	1,000	1,000	1,000	1,000
Variable cost	210	210	210	210	210
Depreciation	480	480	480	480	480

2. United Pigpen is considering a proposal to manufacture high-protein hog feed. The project would make use of existing warehouse, which is currently rented out to a neighbouring firm. The next year's rental charge on the warehouse is $100,000, and thereafter the rent is expected to grow in line of the inflation at 4% per year. In addition to using the warehouse, the proposal envisages an investment in plant and equipment of $1.2 million. This could be depreciated for tax purposes straight-line over 10 years. However, Pigpen expects to terminate the project at the end of 8 years and to resell the plant and equipment in year 8 for $400,000. Finally, the project requires an initial investment in working capital of $350,000. Thereafter, working capital is forecasted to be 10% of sales in each of years 1 through 7.
Years 1 sales of hog feed are expected to be $4.2 million, and thereafter sales are forecasted to grow by 5% per year. Manufacturing costs are expected to be 90% of sales, and profits are subject to tax at 35%. The OCC is 12%. Calculate the NPV of Pigpen's project.

3. The following table reports investment and projected incomes for a new factory. Calculate the cash flows of the project and the NPV assuming a cost of capital of 11% and tax rate of 35%.

		Period								
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Capital investment	83.5								
2	Salvage value									12
3	Working capital	2.3	4.4	7.6	6.9	5.3	3.2	2.5	0	
4	Depreciation		11.9	11.9	11.9	11.9	11.9	11.9	11.9	
5	Sales		27	51.3	89.1	81	62.1	37.8	29.7	
6	Cost of goods sold		9.2	17.4	30.3	27.5	21.1	12.9	10.1	
7	Other costs		15.5	15.5	5.2	5.2	5.2	5.2	5.2	